

Regenerators for 10 Kelvin Cryocoolers, Phase I

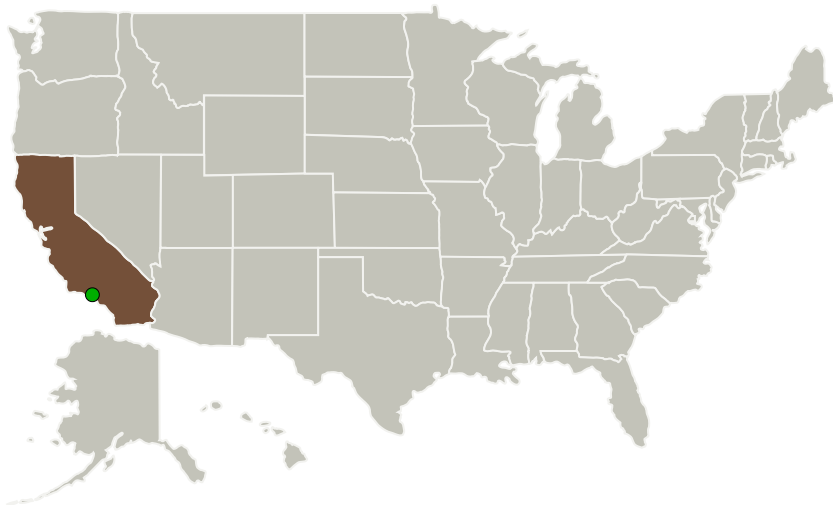
Completed Technology Project (2017 - 2017)



Project Introduction

Future NASA astrophysics and exploration missions will require various enhancements in multi-stage cryocoolers. These include increased efficiency, reduced vibration and reductions in overall system mass and power consumption. For the coolers required, Stirling and pulse tube coolers offer the best opportunities. At present, the efficiency of these coolers is limited by the effectiveness of low-temperature-stage regenerators. Below about 60 K, two factors play key roles in reducing the effectiveness of regenerators. The heat capacity of most materials falls rapidly with decreasing temperature, thus, reducing the efficiency. Also, materials commonly used are only available in powder form, a form known to raise reliability issues. In the proposed effort, we will address both the aspect of high-efficiency and regenerator durability. First, a Rare Earth alloy, that below 60 K has a heat capacity higher than that of commonly used materials, will be configured in a well-defined intricate porous matrix; Secondly, both the void fraction and the ratio of surface area to solid fraction of the regenerator matrix will be tailored using a new approach, addressing that both form and thermal characteristics are essential to achieving a high efficiency.

Primary U.S. Work Locations and Key Partners



Regenerators for 10 Kelvin Cryocoolers, Phase I Briefing Chart Image

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Organizations Performing Work	Role	Type	Location
Atlas Scientific	Lead Organization	Industry	San Jose, California
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations

California

Images



Briefing Chart Image

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(<https://techport.nasa.gov/image/128125>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Atlas Scientific

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

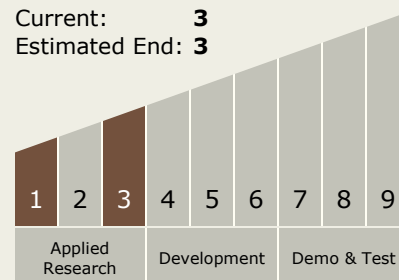
Carlos Torrez

Principal Investigator:

Ben Helvensteijn

Technology Maturity (TRL)

Start: 1
Current: 3
Estimated End: 3



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Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.1 Cryogenic Systems
 - └ TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System